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LINTERS

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CONTENTS.

	Page.		Page.
How obtained-----	3	Sampling-----	7
Character -----	4	Selling-----	7
Length of fiber-----	5	Commercial values-----	7
Production-----	5	Uses-----	8
Handling-----	6	Standardization and new uses needed-----	10

LINTERS.

By A. M. AGELASTO, *Specialist in Cotton Classing.*

With the exception of Sea Island and Egyptian cotton, seed of practically all varieties of cotton bear two commercial types of fibers on their seed coats—a fiber suitable for spinning purposes and a short fiber or fuzz closely matted about the seed. Fiber of the first type is removed and baled at the gins and constitutes the cotton of commerce. The other type, or fuzz, together with such of the first type as may escape removal at the gins, is removed by a second process usually performed at the oil mills in the cleaning and preparation of the seed for crushing and constitutes what is known as "linters." The process of removing the linters at oil mills is generally known as delinting or "cutting."

HOW OBTAINED.

Between 1890 and 1900 there was a saying in the oil business that there was a fortune in store for the man who would invent a means of cleaning the lint from Upland cotton seed so that it would have the appearance of Sea Island or Egyptian seed. Several machines have been invented since that period and the problem has been solved, delinting now apparently having reached the height of perfection.

Formerly linters were detached or cut from the seed by a modification of the regular cotton gins with suitable condensers attached. These condensers put the linters in the form of bats and rolls. This method of delinting produced a cut ranging from 25 to 75 pounds of lint to the ton of seed. When the World War began, linters became very much in demand on account of their value in making explosives. During the war the United States Government arranged with the mills to cut as high an average as 140 pounds of lint per ton of seed, and some mills reached as high as 200 pounds of lint to the ton of seed. In order that this result might be attained, it became necessary that the method of delinting be changed to make a closer cut, and several new systems of delinting machines were installed in the oil mills.

One of the new methods for close delinting was the carborundum system, which removed more of the fibers than the other delinting methods. This was done by bringing the seed into close contact with carborundum cloth or paper, which literally polished the lint from the seed. This cloth or paper is somewhat similar to emery paper, and is attached to rapidly revolving disks or wheels.

Another system installed at the oil mills was known as the suction system, which blew the linters from all the different delinting machines and condensed it after mixing it into one uniform grade, so that each bale of linters was practically the same throughout. However, this system did not put the linters in the form of a bat or felt, preferred by all mattress and other factories, and consequently this class of linters was good for nothing except explosives.

After the Government notified the oil mills that it did not wish to purchase any more linters for explosives, January, 1919, the mills began again to cut to the ton of seed an average of about 65 pounds of lint, known generally as a mattress lint. Furthermore, almost all of the oil mills removed the suctional system and began making linters in rolls and felt, as they had done prior to the war. Many of them, however, had learned the value of the suction system, especially in the great amount of labor saved, and in the cleaner and more uniform product, and were, therefore, confronted with the problem of evolving some method by which they could make use of the suction system and, at the same time, condense linters into the form of felt. Such a method has recently been perfected, so that it is now possible to take all the linters from all the different gins at a mill, mix them, and condense them on a single condenser which delivers them in layers. These layers fall into the press box just as cotton falls into the press, and thus uniformity throughout the bale is assured.

It is generally understood that it is unprofitable to make an inferior grade of linters and the mills attempt to keep their cut as low as possible so as to make a more salable product, except, of course, when some unusual condition presents itself, such as an abnormal demand for such products as explosives.

Besides delinting cotton seed for the purpose of obtaining the lint for commercial uses, the practice of delinting to obtain clean seed for planting purposes is being followed in a few instances. One reason for this is that the soil moisture comes in closer contact with the delinted seed coat, causing a more rapid germination and the production of a better stand.

CHARACTER.

The fiber of linters is somewhat similar to that of the immature or undeveloped cotton fiber, being light and weak in body and staple. The extraneous matter contained in linters is composed principally of broken hulls, small motes, a large amount of lint dust, and some oil. Linters, as a rule, have a very smooth appearance, due to the matting of the fibers. The color of linters varies considerably, the principal shades being gray, yellow, green, greenish yellow, and brown. White is rarely obtained.

The grays, browns, and greens are the natural colors of the short fibers and fuzz. The yellows and others are principally the result

of discoloration from improper storage of the seed after the first ginning. The color of linters does not materially affect the value, but as a rule the grays, browns, greens, and greenish colors are preferred, inasmuch as they are more easily bleached, particularly the green and greenish shades. The color of linters will change to various shades, depending upon the physical conditions such as light, etc., to which the lint may be exposed.

A variation of the cut at the oil mill also has an effect upon the color of linters. The closer the cut, the more coloring matter in the form of seed-coat, lint dust, oil, and foreign matters will appear in the stock. It is interesting to note that the oil mill can at any time change the grade of linters by varying the number of pounds of lint cut to the ton of seed.

LENGTH OF FIBER.

The length of the linter fiber varies considerably. When measurable it may be estimated to range from one-eighth to one-half inch in length. There are certain growths of staple cottons that will produce linters measuring from three-fourths to 1 inch in length, but the quantity of these lengths is negligible. The length of the fiber is also partly dependent upon the time of the year the seed is ginned. The early picked seed almost invariably yields a longer staple than that picked later in the season, for when the cotton is ginned from the early pickings a larger percentage of longer fiber remains on the seed after it leaves the gin. Inasmuch as there are always various lengths of staple in a sample of linters, it is difficult to determine the average staple length of a bale.

PRODUCTION.

There are about 800 oil mills in operation in the United States and the number of bales of linters produced has increased very materially during the past 10 years. The production increased from 3½ per cent of the cotton crop of 1911-12 to 10.09 per cent of the cotton crop of 1918-19. For the sake of comparison the production of linters by years for the last 21 years and the relation of linters to the cotton crop is given below:

Year.	Bales of linters (000 omitted).	Per- centage of cot- ton crop.	Year.	Bales of linters (000 omitted).	Per- centage of cot- ton crop.
1899-1900.....	114	1.2	1910-11.....	398	3.2
1900-1901.....	143	1.4	1911-12.....	556	3.4
1901-2.....	166	1.5	1912-13.....	602	4.2
1902-3.....	195	1.8	1913-14.....	629	4.2
1903-4.....	195	1.9	1914-15.....	856	5.3
1904-5.....	245	1.7	1915-16.....	931	8.3
1905-6.....	230	2.0	1916-17.....	1,331	10.9
1906-7.....	322	2.3	1917-18.....	1,126	10.0
1907-8.....	268	2.3	1918-19.....	929	7.7
1908-9.....	346	2.5	1919-20.....	608	5.4
1909-10.....	313	2.9			

The State of Texas produces the most linters, about 26 per cent of the entire production. Next in line of production come the States of Georgia with 20 per cent; Mississippi, Alabama, and South Carolina, with a total of 25 per cent; and the States of Arkansas, North Carolina, Tennessee, and Oklahoma together producing 24 per cent. The remaining 5 per cent is made up from scattered States. These estimates are based on figures issued by the Bureau of the Census.

Compared to its cotton production, it would appear that the State of Tennessee produces more linters than any of the other States. This is because of the large quantity of undelinted cotton seed that is shipped to Memphis, the most important cotton seed crushing center in the world.

The general increase in the production of linters, of course, is due largely to the closer delinting of the seed, in some cases the seed passing through the delinting machines a second time. One of the important objects of close delinting is to detach as much fiber as possible from the seed, as the more nearly the fiber is removed entirely the greater is the production of linters and the smaller the portion of the kernel carried off with the hulls in the process of oil extraction; consequently, the greater is the yield of oil and lint.

Only a small quantity of linters is produced from the seed of cotton raised in countries other than America. It is noteworthy that British India, the second cotton-producing country, with a crop amounting to about 4,000,000 bales of cotton and about 1,600,000 tons of seed, annually, contributes almost nothing toward the world's linter production. The Indian farmers retain seed for planting purposes and feed the remainder without first crushing it to live stock. This is possible because the hull of the Indian cotton seed is thinner than that of the American seed and, without being crushed, can be digested by the cattle with no evident ill effects. Before feeding to the cattle, the Indian farmer places the seed in an earthen vessel with a proportion of bran and a little salt and allows the mixture to cook for several hours. The production of seed in India is in the proportion of approximately 70 pounds to 30 pounds of cotton.

HANDLING.

Linters are handled in practically the same way as cotton. The baling is done in the same manner: that is, the bales are covered with about six or seven yards of bagging and tied with six iron bands. The size of a bale of linters is similar to that of a bale of cotton, for in almost all cases linters are baled in press boxes similar to those used for cotton. Linters can be steam compressed the same as cotton without injury to the quality of the fiber. Bales of linters weigh about 475 to 650 pounds each, but the average weight is about 500 pounds to the bale.

SAMPLING.

Great care should be exercised in drawing samples from linters in order that a true representation of the qualities contained in the bale may be secured. The method of securing samples from bales of linters differs but little from that used in drawing samples from cotton. Linters are usually sampled from the top and bottom and from each of the two sides of the bale. By top and bottom are meant the two surfaces of the bale which in the press are respectively against the top and the bottom of the press; by the sides are meant the surface of the bales upon which the buckles are placed and the opposite surface. In securing samples from the bales of linters particular care should be taken that the incision is made so deep that the bleached outer surface, if any, will not be gathered without the desired representative part, as the fiber of linters is very susceptible to bleaching, particularly when it has become rain-wet, exposed to the sun, and dried. The green or greenish colors found in linters are more susceptible to bleaching than the other colors or shades. The size of linter samples naturally should vary, depending upon the number of various qualities contained in each bale sampled.

SELLING.

Linters are bought and sold through channels somewhat similar to those for cotton. A number of cotton dealers also handle linters. There are, however, many firms who deal exclusively in linters. In some cases linters are sold by description, covering cut, staple, color, and other qualities. Owing to the fact that linters are almost always mixed-packed, most of the trading is done on actual types or samples which represent the various qualities contained in each bale. The users of linters are located both in America and in Europe—especially Germany.

COMMERCIAL VALUES.

Commercial values of linters naturally vary from time to time, but do not commonly follow fluctuations in the cotton market. The price history of linters is interesting. The average price of the entire product (all grades) derived from the 1912-13 cotton crop is placed at approximately 2.6 cents per pound, f. o. b. oil mills. This price gradually decreased during the next two years, and the 1914-15 production was sold at an average price of approximately 1.5 cents. In 1915-16, when the quality had been reduced by increasing the quantity cut per ton from about 71 to 106 pounds, the average price rose to about 5.9 cents; and in 1916-17, with a still further increase in cut to 149 pounds, to 6.8 cents; while in 1917-18, with a slight decrease in cut from the preceding year and a corresponding improvement in

quality, a substantial reduction in prices resulted even before they were fixed by governmental action.

On May 1, 1918, the Cotton and Cotton Linters Section of the War Industries Board passed a regulation requiring that all linters cut after that date be of the munition type, running 145 pounds and upwards to the ton of seed crushed. This was done in order to insure a sufficient supply for war purposes. The same regulation provided that linters be sold only to the company that acted as purchasers and agents for the Ordnance Department. A price of 4.67 cents per pound was fixed. This regulation was made effective May 1, 1918, and remained in force until late in December of that year when the Ordnance Department recommended to the mills that they reduce the quantity of linters cut from 145 to 75 pounds a ton to avoid the otherwise inevitable oversupply and resulting economic waste.

USES.

The use of linters is quite varied. Below is given a chart showing some of the principal uses made of linters. As the large part of the linters production is consumed in the manufacture of mattresses and explosives, their manufacture is reviewed in outline.

Linters are used for :	Batting. Wadding.	Mattresses. Pads. Cushions. Comforts. Horse collars. Upholstery.
	Stuffing material for	
	Absorbent cotton.	
	Mixing with shoddy.	
	Mixing with wool in hat making.	
	Mixing with lamb's wool for fleece-lined underwear.	
	Felt.	Lamp and candle wicks. Twine. Rope. Carpets.
	Low-grade yarns.	
	Cellulose.	
	Artificial silk. Paper. Basis for explosives.	

MATTRESSES.

The two principal classes of mattresses manufactured from linters are felt mattresses and blown mattresses. In the manufacture of felt mattresses almost all grades of linters that can be made into felt or that can be garnetted can be used. It is estimated that an average cut of 65 pounds per ton of seed is about the lowest grade that

can be garnetted economically. In the manufacture of the better class of mattresses, the linters must have longer staple and be generally of the better qualities. In the manufacture of the blown mattress, almost any grade of linters can be used. The blown mattresses are considered among the cheapest kinds of mattresses and do not give long service, principally because of the packing of the fiber. They are made by machinery which blows the lint into a tick that has previously been sewn up, except for a small hole through which the lint is blown.

EXPLOSIVES.

The approximate constituents of the cotton fiber used in the manufacture of explosives are as follows:

	Per cent.
Moisture-----	6.74
Ash-----	1.65
Protein-----	1.50
Cellulose-----	83.71
Nitrogen-free extract-----	5.79
Fat-----	.61

The processes through which the cotton fiber passes in its preparation for use in the manufacture of gun cotton are described in the following statement, which was prepared by the War Department:

The cotton used in explosives manufacture consists of unspun short fibers, generally the linters and hull fibers, which remain after the earlier ginning has removed the longer fibers more valuable for spinning and less suited to the manufacture of explosives. As an example of the treatment of this material, the United States Army specifications for smokeless powder require that the cotton be purified and bleached and thoroughly washed to remove the purifying and bleaching materials, salts, etc., and that as the result the cotton shall contain not more than 0.4 per cent of extractive matter, not more than 0.8 per cent of ash, and not more than "traces" of lime, chlorides, sulphates, etc.; also that it be of uniform character, clean, and free from such lumps as would prevent uniform nitration. It is delivered to the explosives factory in bales, sometimes compressed, sometimes not, but always covered with paper or other material for protection from dirt.

In making smokeless powder or explosives the cotton generally, after being run through a picking machine to separate the fibers, is dipped in nitric and sulphuric acids to nitrate it, producing nitrocellulose, which is then washed, boiled, cut in a beater or pulping machine, further washed, and then wrung in a centrifugal. Up to this point the only important difference depending upon use is the degree of nitration, being more highly nitrated if for use as a high explosive. Such nitrocellulose, generally called military guncotton, is usually, after the foregoing operations, completed by pressing into blocks. If for smokeless powder the nitrocellulose must, however, be thoroughly dehydrated, mixed with a suitable solvent, and worked to a very stiff paste or colloid, either alone or mixed with other ingredients (nitroglycerin, etc.), and is then forced from a hydraulic press through dies and cut into grains of desired length, and dried.

STANDARDIZATION AND NEW USES NEEDED.

Until the outbreak of the World War, linters were considered an unimportant by-product of the cotton crop. Even now the value of this commodity in normal times is not fully recognized.

So far, no steps have been taken toward the standardization of linters. When, during the recent war, the United States Government commandeered all linters, a great deal of difficulty was experienced in many quarters in establishing values for the various qualities, this naturally leading to disputes and controversies. It would seem, therefore, that inasmuch as the quantity of linters and their money value now are matters of such importance, steps should be taken to establish some workable trading standard, especially now that linters are used less extensively for explosives and are on the market for other uses. Unless this country has some uniform guide by which to trade in linters commerce in that commodity will be greatly hampered.

There is no question that the situation with reference to the handling and marketing of linters can be materially improved, not only through establishing standards but also through the utilization of this fiber in the manufacture of such articles as are now being manufactured from other materials, particularly with reference to wood pulp. From an economic standpoint, unless some means of further utilization of linters is found, the result may be a repeated overproduction of this stock each cotton season, leading ultimately to a huge waste of the material. However, it is understood that recent experiments in the manufacture of high grade paper from linters have proved successful, and that this new industry bids fair to furnish in the future an outlet for large quantities. It is hoped that other commercial uses will be developed.

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